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that when  $t = \frac{1}{150}$ , the above proportion was as 3 : 2, which gives for  $\kappa$  a value = 35, agreeing closely with the values found by Weber and Thalen. In the case of iron of the quality experimented on by the authors, this ratio would be

$$t + \frac{1}{100} : t.$$

Hence in the case of a tank  $\frac{1}{10}$ th of an inch thick and 4 feet in diameter,  $t$  would be about  $\frac{1}{250}$ , and the effect about  $\frac{1}{35}$  that of a solid mass of iron of the same size. These results, which, however, are not new, as they are involved in Poisson's paper of 1824, explain the mistakes into which various magneticians have fallen as to the magnetism residing entirely on the surface, and as to the effect of a body such as a tank depending on its surface, not on its mass.

The same formulæ show that to correct a quadrantal deviation of  $6^{\circ} 10'$  by two cannon-balls placed one on each side of the compass, the distance of the centre of each ball from the centre of the compass should be three radii of the balls. If the distance is greater or less, the quadrantal deviation corrected will vary inversely as the cube of the distance.

The investigation also shows that the effect of a sphere of iron, if its centre be within the cone of  $54^{\circ} 45'$ , will be prejudicial both by diminishing the directive force, and by increasing the heeling error to windward. When without that cone it will be beneficial in both respects. Hence, as far as possible, no iron should be within this cone.

Masses of iron which may be compared to a sphere, and near the level of the compass, but in the fore or aft quadrant, are beneficial in increasing the directive force, but prejudicial in increasing the quadrantal deviation. If they are on the port or starboard quadrant, they are doubly beneficial, by increasing the directive force and diminishing the deviation.

Bodies which may be compared to infinite vertical cylinders, such as iron masts placed before or abaft the compass, are prejudicial by increasing the quadrantal deviation, and they do not increase the directive force.

*March 23, 1865.*

Major-General SABINE, President, in the Chair.

Pursuant to notice given at the last Meeting, Count Strzelecki proposed, and the Master of the Mint seconded, the Right Honourable the Earl of Donoughmore for election and immediate ballot.

The ballot having been taken, the Earl of Donoughmore was declared duly elected.

The following communications were read :—

I. "Inferences and Suggestions in Cosmical and Geological Philosophy." By E. W. BRAYLEY, F.R.S. Received February 23, 1865.

Theory of the Sun—Synthesis of Ponderable Matter in the Sun—Cause of the Solar Spots—Production of the Zodiacal Light—Origin of Meteorites—Original Formation of the Planets—Discrimination of the Views in Cosmical Philosophy advanced from those of Mayer and his School—Theory of the Minor Planets—Projectile Power of the Sun.

(Abstract.)

This paper commences with the "*Theory of the Sun*," embracing the subjects of the source of its energies, and the synthesis of ponderable matter. The position, powers, and functions of the Sun, as the physical centre of the solar system, are peculiar, and in fact unique. The "Primary Induction" from them, indicating, in the author's opinion, "the principle of philosophical investigation" which should be applied to the Sun, is conceived to be "That they imply a corresponding uniqueness and peculiarity in its constitution, characterizing also the nature as well as the disposition of the substances of which it essentially consists. But the particular density of the Sun indicates that it actually consists both of ponderable and imponderable matter. The nature of the former as constituting apparently its relatively exterior regions [is] believed to be made known in part by Professor Kirchhoff's researches in Prismatic Chemistry applied to the Sun, as showing that some of the elementary substances of the Earth exist also in the Sun"\*.

The first obvious verification of this primary induction is presented by the "form of the Sun, which according to the observation of the equality of its diameters, is that of a perfect sphere, a form which is unique in the solar system, and is probably unknown in Terrestrial Nature"\*.

The cardinal peculiarity of the Sun, that in which it is unique in the highest sense, is that its radiation exclusively possesses the property of imparting to (inorganic) matter a fit condition for the manifestation of (organic) life; that it is, humanly speaking, infinite in amount, and also the source of all the heat and light, and consequently of all their derivative or correlate forces which are active in the solar system. The illustration of the temperature and expenditure of heat of the Sun founded by Sir John F. W. Herschel upon his own experiments and those of M. Pouillet, with Mr. Waterston's experimental result that the potential temperature of an infinitesimal area of the Sun's radiating surface is nearly thirteen millions of degrees of Fahrenheit's thermometer, are cited as being in fact nothing more than philosophical confessions that no proportion whatever can be established between any expression for the solar energies and the obvious reality of their incalculable amount.

The author proceeds to inquire what we may reasonably conceive to be

\* Syllabus of Lectures on Astronomical Physics, delivered at the London Institution in 1864, here cited from a revised edition printed for private use. Lecture V.

the intimate nature of matter in its highest and most elementary character, such as that essential to the Sun is in this paper inferred to be, agreeably to the principle of philosophical investigation he has suggested as being alone applicable to the Sun, and according to known facts and recognized principles of science. The answer to this question is afforded, he conceives, by modern views of the constitution of gaseous substances as forms of ponderable matter, and of that of the luminiferous ether as an imponderable body. It is deduced from the former, combined with the investigations of philosophers during the last half century, including those of the late Dr. Thomas Young and M. Cauchy, and of M. Neumann and Professor Stokes, that the ether is characterized by enormous molecular activity, rendering it immensely rarer but at the same time more truly solid and elastic than any kind of ordinary or ponderable matter, all forms of which it pervades, even the most dense, coexisting with them in the same space.

The author infers that the substances peculiar to the Sun transcend the ether in these qualities in even a greater degree than that excels ponderable matter with respect to them—that is, succinctly, that pure solar matter is still more transcendently and intensely solid and elastic because its particles are in still more transcendent activity. This inference is considered to harmonize with the obvious peculiarity of the Sun, that in it alone, of all the bodies and localities of the solar system, enormous force of gravity and an immeasurable intensity of heat are united.

In the recorded facts of telescopic observation, the author finds an “entire absence of evidence or indication that anything exists in the sensible universe which is of greater antiquity than the stars, or prior to them in its origin;” which, “considered together with the primary induction from the uniqueness and peculiarity of their position and functions as suns,” is regarded as tending strongly “to prove that, as a class, the stars are the most ancient objects in the Creation, and also (each in its own sphere of action) the origins of the series of physical agencies and processes by which the planets and other classes of heavenly bodies were finally produced and are maintained”\*.

This being admitted, it follows that the original production of ponderable matter takes place in the stars, and in our Sun as one of them,—a conception to which the author had been led by the preceding and other considerations long before the application of prismatic chemistry to the Sun.

The energy set free in the *condensation* within the Sun, of the highest imponderable matter essential to it into ponderable matter (an expression which is shown not to be a solecism), and eventually into the metallic vapours which the observations of Kirchhoff and other spectroscopists have discovered in the Sun and other stars, is inferred by the author to be, at once, the exclusive proximate source of the heat and light and other energies of the Sun, and (in our solar system) the only and universal

\* Syllabus of Lectures on Astronomical Physics. Lecture VIII.

origin of ponderable or ordinary matter, the absolute synthesis of which from its imponderable elements is thus believed to take place in the Sun.

It will follow that the distribution of heat in the Sun, as already inferred by the author\*, is from within to without, in the order of decreasing intensity—an inference which he conceives to be not contradicted, but supported, by the apparently inferior calorific and luminous condition of the Sun's nucleus, as disclosed in the true nuclei or inner umbræ of the spots, compared to that of every other visible part of the Sun, and especially of the photosphere, because the exterior regions of the Sun are composed entirely of that order of matter—ponderable matter, such as that of which the planets consist—which is alone capable of communicating to the ether of space those vibrations which we know as heat and light.

The "*Cause and Nature of the Phenomena termed the Solar Spots*" are next considered. The energy arising from the transition of imponderable into ponderable matter, will in part become the centrifugal or projectile force by which the torrents of matter (finally assuming the gaseous form) so produced are impelled through the denser envelopes of the Sun, causing the spots and the other phenomena of ebullition of which the photosphere is the scene.

The rotation of the Sun acting upon these torrents issuing radially from its interior regions—and probably from the surface of the solar globe disclosed in the true nuclei of the spots, or somewhat within that—by inflecting them towards the Sun's equator as they rise, occasions the actual distribution of the spots which are their outbursts on the surface of the photosphere, in lines and belts parallel to the equator, their restriction in latitude to within a certain distance of it, and their absence, together with that of the *faculæ*, both in the equatorial and the polar regions of the Sun. It would seem that the originally uniform evolution of æriform matter from the entire surface of the interior globe, on being swept towards the equator from each pole, is broken up into torrents by the same general cause, and by the resulting inequalities of temperature, density, and consequent resistance in the surrounding and incumbent mediums. The region of equatorial calm, or freedom from spots and *faculæ*, is the result of the meeting and mutual opposition of the systems of currents which the Sun's rotation causes to proceed from either pole, the torrents being carried back in each hemisphere by movements of the nature of circular waves of translation seemingly affecting all the envelopes of the Sun, and setting from the plane of junction at the equator towards the tropics.

The entire assemblage of actions now under consideration appears to be closely analogous to that exhibited by a liquid boiling violently and incessantly from a heated surface below, the gaseous matter evolved at which becomes partly diffused through the liquid by adhesion or mixture, is partly disseminated through it in bubbles which collapse at various depths, and partly escapes by effervescence at its upper surface. In the actual case of

\* Companion to the Almanac for 1864, p. 51.

the Sun, torrents more or less permanent, consisting either of bubbles or of an unbroken stream of æriform matter, are also formed by the operation of the controlling mechanical cause to which, acting in the second place, the entire system of phenomena presented by the spots is here attributed. These torrents are continuously maintained from near the surface of origin on the glowing sphere within to that of the photosphere without, whether in single or in groups of separate but probably often confluent streams, elevating the photosphere into faculæ by the force of expansion with which they burst upon it, and, being transparent, permitting the interior envelopes and the incandescent nucleus to be seen through them.

The system of currents necessarily produced by the heat-action in the inferior liquid mediums and photosphere, combined with those due to the sun's rotation, carry along with them the torrents and their bursting summits in the drifting motion observed by Mr. Carrington to affect the spots. The phenomena of the spots generally, especially as described by that astronomer, are in entire conformity with this interpretation of them. Their control by the Sun's rotation was first perceived and announced by Sir John Herschel, in connexion, however, with his cyclonic theory of their nature.

The observed spherical form of the Sun is considered to be preserved by the perpetual escape from its equatorial regions, by means of the ebullition of the spots, of matter which in consequence of the Sun's rotation would otherwise accumulate upon them and so cause a deviation from the spherical form. Being thus separated, it receives from the Sun's rotary motion at the equator the form of the *Zodiacal Light*, which it thus constitutes, while the perpetual supply of fresh matter from the solar surface causes it to be, not a ring, but a lenticular mass, geometrically though not physically continuous with the originating central body, which it thus envelops, no interval apparently being left between them.

§ The next objects of discussion are the "*Origin of Meteorites, Series of Physical Processes of which they are the result, and their Functions in Nature.*"

The vapours of metallic and other elementary matter evolved or discharged in the ebullition of the photosphere above considered, partly remain upon the Sun, constituting its atmospheres\*, but are principally aggregated into masses of immense magnitude (terrestrially speaking) of the nature of bubbles, which, having undergone a certain amount of condensation, first become visible as those particles the collective brightness of which reveals to us the existence of the zodiacal light, being, in fact, the matter separated from the Sun's equator as explained above. These particles, termed by the author *meteoritic masses*, are projected from the zodiacal light by the force to which its variable extension is owing, and are further gradually condensed during their passage through the interplanetary spaces into the liquid and solid state, constituting eventually the nuclei of Meteors, which are finally precipitated upon the Earth (and doubtless upon the other planets) in the form of METEORITES.

\* Companion to the Almanac for 1864, p. 46; for 1865, p. 53.

The sudden outburst of light over a solar spot witnessed on September 1, 1859, by Mr. Carrington and Mr. Hodgson, the author regards as a fact confirmatory of these views, and as having been the consequence or accompaniment of the production, and the transfer with immense rapidity from within to without some exterior region of the Sun, of a meteoritic mass, or more probably of an immense congeries of such masses, enabled, by its consisting of ponderable matter, to manifest the higher temperature and consequent greater effulgence of the interior regions of the luminary, whence it was originally derived. Certain phenomena before recorded by astronomers but not yet understood are probably of the same nature.

The structural characters of meteorites are those of bodies which have been originally condensed from heterogeneous vapours—the mingled vapours of uncombined elementary substances variable in their nature and requiring different temperatures for their maintenance in the gaseous form, but all existing originally at a very high temperature; and their adequate investigation may afford, as an *experimentum crucis*, an independent confirmation of Kirchhoff's discovery, and of the truth of the spectrum-analysis of the composition of bodies distant from us in space. They consist, mineralogically, of two groups, meteoric iron and meteoric stones, forming, however, by graduation into each other, as first pointed out by the author, many years since, one series of bodies\*. The intermediate examples, and indeed most of the stones, are aggregates of earthy matter partly in the crystalline and partly (as Mr. H. C. Sorby has shown†) in the vitreous state, and distinct portions of metallic iron alloyed with other metals. They are, in fact, always heterogeneous aggregates, in conformity with the origin here assigned to them. While as a class meteorites are perfectly distinct from all terrestrial rocks—the presence of metallic iron as a mineral constituent imparting to them indeed a character which is perfectly unique—some of their constituent minerals, and all the elementary substances of which they are composed are such as are found, but differently associated, in the Earth's crust, although there are many other terrestrial elements which have not yet been discovered in them.

“Ten, or perhaps more, of the elements of the solar atmosphere,” according to Kirchhoff and Ångström, “are also those of meteorites—iron, nickel, cobalt, chromium, and magnesium being characteristically such. But the non-metallic base silicon, which, in union with oxygen as silica, is an abundant and equally characteristic element of meteorites, is absent in the Sun, according to our present knowledge, in which also other elements of meteorites, including oxygen itself, are not known to be present”‡. It cannot be doubted, however, that by the further prosecution of spectrum-analysis other elements will be discovered in the Sun. It must be remembered also that our knowledge of meteorites is confined to a few only of

\* Annals of Philosophy (January 1824), second series, vol. vii. p. 73; Philosophical Magazine (December 1841), third series, vol. xix. p. 501.

† Proceedings, vol. xiii. p. 333.

‡ Companion to the Almanac for 1865, p. 65.

those which have fallen upon the Earth, and that during a very small space of time, physically speaking, not exceeding a few thousand years, or perhaps even not many centuries; while the synthesis of ponderable matter in the Sun may reasonably be supposed to vary from time to time as to the particular chemical elements produced. A remarkable and instructive fact, in the actual condition of science on this subject, is that the metal iron is now known to be an abundant and characteristic element of the Sun, of Meteorites, and of the Earth.

In harmony with these views on the origin of Meteorites is a recorded but perhaps hitherto unpublished opinion of Sir H. Davy, that they originally consist of the metallic and other combustible bases of the earths and alkalis of which Meteoric Stones are principally composed. But whether the oxidation of these bases is effected in the Earth's atmosphere, as he also suggested, or whether in some cases, though not in all, oxygen is present in the original assemblage of elementary vapours, and combines with certain bases and with portions of others, as the condensation proceeds, is a difficult question. The latter theory may be thought to agree better with the entire series of phenomena presented by Meteors, and with the constitution of Meteorites as a peculiar class of mineral aggregates; but some facts relating to either branch of the subject tend to support the former. Both may be true to a certain extent. The facts, however, that scarcely any oxidation of the iron Meteorites has taken place, and that there are no meteorites which consist principally of oxide of iron, while there are some in which metallic iron and earthy matter (oxides) are present in nearly equal proportions, but that even in these no excess of oxide of iron occurs, are opposed to the supposition that meteorites have derived any considerable part of their oxygen from the atmosphere; with which also the existence of sulphide of calcium in certain meteorites is inconsistent.

In what part of Space between the Zodiacal Light and the Earth the final condensation takes place is not at present determinable. It would seem that these masses must retain much of their original heat and therefore to a great extent an æriform or vaporous condition (though one of greater density than that in which they left the Sun or even the Zodiacal Light, and mingled with liquid or solid matter as just suggested) in the interplanetary spaces where the ether alone exists, and that their entire conversion into a liquid and finally a solid form may not occur until their arrival in a region of positive cold in the vicinity of the Earth or other planets. Mr. Sorby has lately inferred from the equable manner in which mineral ingredients greatly differing in specific gravity as well as fusibility are mingled in meteorites, that their formation must have taken place in some physical locality where the force of gravitation is small; "that they come either from the outside of a very small planet, much less than the moon, or else from the *interior* of a larger planet, since broken up"\*. The first inference is in perfect accordance with the theory of Meteorites announced in this paper; for it is evident that the force of gravity in the original meteoritic masses

\* Letter to the Author.



must be very small, quite inadequate to interfere with the disposition within them, and among one another, of their proximate elements, however discordant in fusibility or specific gravity. It will follow, also, that the final condensation of these vaporous masses cannot take place either very near the Sun or very near the Earth.

According to observations of the author already published\*, the iron meteorites, if not certain single Meteoric Stones (and most probably also the entire nucleus, which in some cases is broken up and falls as a shower of Meteorites), have the form (resembling that of the Meteors themselves, which is nearly that of a flame) of the solid of least resistance, or of one derived from it, and received in fact from the resistance of a medium they have traversed, but having in general one termination, and sometimes the other also, truncated to a variable extent. This would seem to prove that they must once have been—as individual masses, and not merely as portions of a body of which they originally formed part, nor as to their pre-existing materials only—in a fluid or mobile condition. These and other significant circumstances are adduced in the paper as tending to the discrimination of the physical changes by which meteoritic masses are affected prior to their entering the Earth's atmosphere, from those which they afterwards undergo within it and from its action,—the conclusion arrived at being that the solid Meteorite is finally left, with a slight alteration in figure, and however greatly reduced in volume, in the approximate actual form—that of a *bubble* elongated by its being impelled in a certain direction through a resisting medium—in which, when in a gaseous state, it left the Sun.

The phenomena of Luminous Meteors (Shooting-Stars and Fire-balls) more or less examined by physicists from the latter part of the preceding century (the author having himself endeavoured to elucidate certain characteristic phenomena of Fire-Balls by applying to them the results of modern science†), but which, since the appearance of the persistent Meteor-shower in November 1833, have been so assiduously observed and discussed by meteorologists, especially in relation to the periodicity they exhibit, are shown to be entirely conformable to the views of their origin which are enunciated in this paper. The petrological characters of Meteorites themselves, as recently investigated by mineralogists‡, together with others before noticed by the author§, are also accounted for by

\* First announced in Lectures on Igneous Meteors and Meteorites given at the Royal Institution in 1839, and at the London Institution in 1841. See English Cyclopædia, Div. Arts and Sciences, "METEORS, IGNEOUS or LUMINOUS," vol. v. col. 604.

† See "A Sketch of the Progress of Science respecting Igneous Meteors and Meteorites during the year 1823," read before "the Meteorological Society" May 12, 1824, and published in the Philosophical Magazine (for October of the latter year), first series, vol. xiv. pp. 288–292; also Second Supplement to the Penny Cyclopædia, "METEORS, IGNEOUS or LUMINOUS," and English Cyclopædia, as referred to in the preceding note.

‡ Reichenbach, Haidinger, G. Rose, Maskelyne, Sorby, R. P. Greg.

§ Syllabus of Lectures, on Igneous Meteors and Meteorites, delivered at the London Institution in 1841, as reprinted in Phil. Mag., third series, vol. xix. p. 501, with addition, p. 502.

these views, though, with respect to the former, in a very different manner from that hitherto accepted.

The long-continued study of Meteorites and of the phenomena which attend their fall, affected by the consideration of the probable synthesis of ponderable matter in the Sun, and—since the conclusions of Kirchhoff have been announced—the special study of Solar Physics and Chemistry in connexion with both subjects, appear to the author to justify him in entertaining the hope that he may thus have succeeded—by means, partly, of a new deductive cosmical hypothesis submitted for verification, and partly by uniting, and in some cases newly interpreting, preceding inductions on particular points of their physical history—in effecting at least the approximate solution of the problem of the Origin and Formation of Meteorites, which has been sought by philosophers from the time of the communication to the Royal Society, now sixty-three years since, of Edward Howard's paper, demonstrating their peculiar nature and establishing the reality of their fall\*.

The succeeding section of the paper is headed "*Original Formation of the Planets: Origin of the Primitive Heat of the Earth, causes of its Permanence and Invariability; the Earth not a cooling body.*" In this it is represented that the results of modern science conspire to prove that we must look to causes now in operation as those which have produced the planets. "If—as first evinced by Mr. G. Poulett Scrope, with respect chiefly to volcanic and plutonic action, and secondly, but from a wider induction by Sir C. Lyell—they are sufficient to account for the phenomena of its surface and crust, as made known by Geology, it follows, by parity of reasoning, that they will be sufficient to account also for its original production. The only known phenomenon in which the process of the formation of the Earth as a planet is actually observed, is that of the fall of Meteorites upon it, by which its magnitude is augmented, and that by the addition of materials homogeneous with those of its existing elementary constitution, being chiefly those chemical elements which are present in the greatest quantity in the Earth's crust, and seem to be most essential to its constitution. The characteristic presence of iron in both has been already adverted to. According to the principle of the adequacy of Existing Causes, therefore, we must conclude that the fall of Meteorites is a continuation or a residue of the process of formation of our planet, and that the Earth was originally produced by the aggregation and coalescence of Meteorites, or of greater masses into which they had previously coalesced.

Agreeably to the law of the Conservation of Energy and to the dynamical theory of heat, the enormous original velocity of the Meteorites being diminished by their collision and coalescence, great part of the mechanical force of their motion would be reconverted into heat, and become eventually the "primitive" internal heat of the Earth, for which it would appear that what may be reasonably characterized as a *vera causa* is thus supplied.

\* Read February 25, 1802; published in the 'Philosophical Transactions' for that year, Part I.

It is next shown in the paper in what manner a nucleus of hypogene rocks or plutonic granite supplying the materials for the subsequent deposition of sedimentary strata, and also the chemical elements of organic beings, would be one of the final results of the Earth's formation by the coalescence of meteoritic masses. The chemical action of its primitive and central heat, governed by the solar radiation upon the exterior of the new planet, would initiate the cycle of correlate activities by which its permanence would be secured. In addition to thus assigning a natural and adequate cause for the secular invariability of the Earth's internal heat, sometimes assumed as an axiom in geological speculations without being accounted for, these suggestions may evince that, on the other hand, it is unnecessary to regard the Earth as a cooling body.

Admitting the Earth to have been formed as here suggested, such also must have been the process of formation of the other Planets.

A "*Discrimination of these views in Cosmical Philosophy from those of Mayer and his School*" is here interposed. The induction by which the original formation of the Earth and other Planets is arrived at in this paper is new; but from that point these views have a certain parallelism with those founded on the "Celestial Dynamics" first enunciated by Mayer, for a knowledge of which English scientific literature is chiefly indebted to the zeal of Professor Tyndall. Of the Mayerian Theory that presented in these "Inferences and Suggestions" is virtually in nearly every stage the inversion, though not suggested by nor produced by inverting it, having been founded on different data and arrived at by independent reasoning. According to the physicists of the Mayerian school, the activities of nature begin with the mutual attraction of "Cosmical Masses" of which Meteorites are taken as examples\*. In the theory now offered they commence with Force and Heat and Light and Matter locally originating in the Sun.

The "*Theory of the Minor Planets*" is next briefly considered. All the phenomena they present are regarded as supporting the conclusion that their peculiar relations and community of character are not, as hitherto supposed, effects of their having formerly constituted one heavenly body which has been reduced to fragments, but of their being bodies intrinsically of the same nature, meteoritic masses in fact, in an advanced intermediate state between the condition of meteorites and that of true planets, in process of gradual convergence towards each other, preparatory to their coalescence into one greater planet.

The last section relates to the "*Projectile Power of the Sun*," accounted for in the section on the Spots, and by which meteoritic masses are conceived to be transferred with great velocity to the interplanetary spaces.

Everything here ascribed to the Sun is of course intended to apply in a general manner to the Stars also, so far as our knowledge of them extends; agreeably to the primary cosmical truth that they are Suns, "which must

\* Companion to the Almanac for 1865, pp. 41-70.

be characterized, each in its own System, by the Uniqueness and Peculiarity which characterize our Sun in its System" \*.

No suggestion is offered in this paper as to the remote origin of the solar elements, or that of the force by which they are conceived to be condensed into ponderable matter.

## II. "On Zoological Names of Characteristic Parts and Homological Interpretations of their Modifications and Beginnings, especially in reference to Connecting Fibres of the Brain." By Prof. OWEN, F.R.S. Received March 10, 1865.

In a paper "On the Commissures of the Cerebral Hemispheres of the Marsupialia," &c., of which an 'Abstract' appears in the last published Part of the Proceedings of the Royal Society (No. 72), the author quotes the definitions of those structures given as zoological characters by me in a brief summary of the primary divisions of the class *Mammalia*, communicated to the Linnean Society in 1857.

The remarks on the signification and homology of those structures in my anatomical publications are not given, I am consequently misrepresented. Errors are imputed to me which the author deems it important to rectify before the Royal Society; and as the Proceedings of the Society will carry this imputation far and wide through the world of science, I venture to hope that the present defence will not be deemed uncalled for, but may be permitted to have place in the Serial which has diffused the attack.

In this I am moved, less on personal grounds, than in the interest of science and of scientific ethics; for of late a practice has arisen of representing a zoological definition of a part which an anatomist may have given in a classificatory work, as the exponent of his homological knowledge and descriptions of such part, in its various modifications and grades of development. Cuvier, for example, in his characters of the order *Bimana*, affirms that Man is the only animal possessing 'hands' and 'feet':—"L'homme est le seul animal vraiment *bimane* et *bipède*" †.

The *Quadrumana* are differentiated as having 'hands' instead of 'feet,' a 'hand' being defined as having the thumb opposable:—"Le pouce libre et opposable aux autres doigts, qui sont longs et flexibles" ‡.

The aim of the author in the zoological work above cited was to impart obvious and easily apprehended differential characters of the organ which observation had shown to define the groups.

The naturalist, thus enabled to place his subject in its proper class or order, is not concerned, as such, in knowing the homological or transcendental relations of the part or character which has afforded him the means of effecting what he wished to do.

\* Syllabus of Lectures on Astronomical Physics, Lect. VII.

† Règne Animal, tom. i. p. 70, 1829.

‡ Ibid. p. 85.